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## PATENT SPECIFICATION

(11) 1 352 166

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- (21) Application No. 24802/71 (22) Filed 19 April 1971  
 (31) Convention Application No. 7 012 714  
 (33) France (FR)  
 (44) Complete Specification published 8 May 1974  
 (51) International Classification B04C 3/00 // F01P 11/00  
 (52) Index at acceptance  
 B2P 10C2 6X  
 F1B 2C7J 2C7P

(32) Filed 8 April 1971



## (54) IMPROVEMENTS IN OR RELATING TO A GAS REMOVING DEVICE FOR A FLOWING LIQUID

(71) We, AUTOMOBILES PEUGEOT and REGIE NATIONALE DES USINES RENAULT, both French Bodies Corporate, residing respectively at 75 Avenue de la Grande Armée, 75 Paris, France, and 8-10 Avenue Emile Zola, 92 Billancourt, France, do hereby declare the invention for which we pray that a patent may be granted to us and the method by which it is to be performed to be particularly described in and by the following statement:—

The present invention relates to the removal of gas from a liquid flowing through a conduit which may be, for example but not exclusively, part of a liquid cooling circuit of an internal combustion engine.

It is known that in such a circuit it is usual to remove the gas in a part of the path where the liquid is sufficiently calm to permit the bubbles of gas drawn along to assemble at the surface of the liquid. This calm zone is located either in the upper part of the cooling radiator or in a separate vessel which also serves as an expansion chamber for the liquid.

It will be understood that the gas removing operation is the more effective as the calm zone in which the separation of the gas from the liquid is effected is traversed by the major part of the total flow of liquid, since the liquid which does not pass through this zone can retain bubbles of gas in suspension and re-introduce them into the engine.

Unfortunately, it is impossible to pass the whole of the flow of liquid through the calm zone under all circumstances for the following reasons:

—the circuit assembly often comprises a large number of branch pipes (cooling radiator, with possibly a by-pass, heat exchanger for a compartment of the vehicle, heating system for the carburettor, heating system for the induction pipe) the most important of these branch connections being

possibly open or closed (cooling radiator, heat exchanger);

—it is not possible for lack of available space to install a gas removing device of sufficient capacity and to connect it by sufficiently large section pipes.

Under these conditions, the gas removal is imperfect and bubbles of gas may be reintroduced into the engine at least under some conditions of operation.

An object of the invention is to remedy this drawback by means of an improved gas removing device of simple construction which enables almost all of the bubbles of gas contained in a moving liquid in a circuit to be removed in a relatively small branch circuit.

According to the present invention there is provided a device for removing gas from a liquid, especially but not exclusively from a cooling liquid flowing in the cooling circuit of an internal combustion engine, said device comprising a conduit adapted for insertion into said cooling circuit, means for producing whirling motion of the liquid in said conduit, and a gas take-off tube located in said conduit, said means for producing whirling motion comprising at least one helical element extending around a central core coaxial with said conduit and having a tapered end portion on the downstream side thereof, and said gas take-off tube being located in said conduit downstream of said central core and coaxially therewith and branching at its end remote from the central core outwardly through the conduit wall.

The invention will now be described with reference to an embodiment shown in longitudinal section by way of example in the accompanying drawing.

In the drawing, the gas removing device comprises a conduit 1 with an inlet 2 for liquid from which gas is to be removed and an outlet 3 for the liquid from which gas

has been removed. An enlarged intermediate portion 4 of the conduit contains a centre core 5 about which extends one or a plurality of helical elements 6. The core 5 terminates in a tapered portion 7 at the downstream end thereon.

The entrance of a take-off tube 8 is disposed in front of, and at short distance from, the tapered portion 7.

10 The device operates in the following manner:

The liquid containing bubbles of gas or vapour in suspension enters by way of the inlet 2. Under the effect of the helical 15 elements 6 it is driven in an intense whirling motion which results in the assembly of all these bubbles of gas or vapour along the axis of the conduit owing to their low density relative to the liquid. The tapered portion 20 of the core 5 helps to guide the bubbles along the conduit axis.

The centre stream of emulsified liquid having a diameter which is the smaller as the whirl is more rapid thereafter enters the 25 take-off tube 8 and is piped, for example, to a container where the gas is separated from the liquid. The rest of the liquid from which the gases or vapours have been removed issues at 3 in passing around and 30 alongside the take-off tube 8 in the direction of arrows f.

The device may be included in the cooling circuit of an internal combustion engine.

This device may be placed directly on 35 the outlet of an engine upstream of the thermostat valve which stops the flow in the radiator so long as the cooling water does not reach a sufficient temperature. The device is therefore traversed by the whole 40 of the cooling liquid stream which passes through the engine irrespective of the conditions of engine operation.

The separation of the gas from the liquid emanating from take-off tube 8 takes place in a feeder forming part of the cooling circuit, which feeder also acts as an expansion chamber for the liquid. 45

WHAT WE CLAIM IS:—

1. A device for removing gas from a liquid, especially but not exclusively from a cooling liquid flowing in the cooling circuit of an internal combustion engine, said device comprising a conduit adapted for insertion into said cooling circuit, means 55 for producing whirling motion of the liquid in said conduit, and a gas take-off tube located in said conduit, said means for producing whirling motion comprising at least one helical element extending around a central core coaxial with said conduit and having a tapered end portion on the downstream side thereof, and said gas take-off tube being located in said conduit downstream of said central core and coaxially 60 therewith and branching at its end remote from the central core outwardly through the conduit wall.

2. A device as claimed in claim 1, wherein the core is arranged in a part of 70 the conduit having a larger diameter than that part of the conduit containing the coaxial part of the gas take-off tube.

3. A device, for removing gas from a liquid substantially as herein described with 75 reference to the accompanying drawing.

4. A liquid circuit having a device therein as claimed in any one of the preceding claims.

5. A cooling circuit of an internal com- 80 bustion engine having a liquid circuit as claimed in claim 4.

MARKS & CLERK.

1352166 COMPLETE SPECIFICATION

1 SHEET

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